

REMARKS

I. Election/Restrictions

In the Office Action dated December 24, 2009, the Examiner stated that each of amended claims 1, 14 and 15 (filed on August 25, 20008) is directed to non-elected species and a non-elected invention.

Applicants respectfully traverse.

However, while not acquiescing to the Examiner's position, in an effort to expedite prosecution Applicants have amended claims 1, 14 and 15 to delete the limitations concerning a "hard coat layer" and an "alkaline earth metal salt". Thus, each of claims 1, 14 and 15 correspond to previously elected Species A(a) and B(a), as noted by the Examiner.

Reconsideration of the withdrawal of claims 1, 14 and 15 is respectfully requested.

II. Rejection under 35 U.S.C. 103(a)

In the Office Action dated April 24, 2008, the Examiner rejected claims 1, 3, 5, 14 and 15 under U.S.C. 103(a) as being obvious over Lange et al. (US 4816333) in view of Takahashi et al. (US 6251523). Specifically, the Examiner stated:

that Lange et al. teach the laminated structure of the present invention except that Lange et al. are silent about the use of a "colloidal solution comprising chain silica fine particles (moniliform silica strings)"; and

that, however, Takahashi et al. disclose the use of a "colloidal silica solution comprising chain silica fine particles and silica (colloidal forming hydrolysable silica) for forming a coating on glass windows having a small reflectivity (antireflection at high incident angle for an improved visibility)".

Applicants respectfully traverse.

As can be seen from claim 1 of the present application, the silica-containing laminated structure of the present invention has the following characteristic features:

- (i) The porous silica layer has a refractive index of 1.22 or more and less than 1.30.
- (ii) The porous silica layer has a pencil hardness of H or higher.
- (iii) The porous silica layer has a specific pore size distribution (represented by formula (1) shown in claim 1).
- (iv) The laminated structure has a minimum reflectance of from 0.1 to 0.45 %.

The porous silica layer is formed from a coating composition containing specific moniliform silica strings.

Applicants respectfully submit that the laminated structure having the above-mentioned characteristic features (i) to (iv) is not obvious over Lange et al., even in view of Takahashi et al. Applicants provide more specific explanations below.

As already discussed in the Applicants' previous responses, and as also apparent from claim 1, as explained above, the silica-containing laminated structure of the present invention is excellent in respect of both optical characteristics and strength, which could not be simultaneously improved by the conventional techniques. As apparent from claim 1 of the present application, such excellent characteristics are achieved due to the use of a coating composition produced by mixing a dispersion of moniliform silica strings having a specific dimension with a hydrolysable silane, which coating composition contributes to the formation of the above-mentioned specific pore structure of the porous silica layer. This is quite unexpected because, as taught at col. 5, lines 28 to 36 of Lange et al., it has conventionally been believed that the "particle agglomeration prior to preparation of the coating composition" should be prevented.

With respect to the advantages of the present invention over Lange et al., the Applicants submitted the Declaration under 37 CFR 1.132 of Mr. Masayuki Nakatani (hereinafter “the Nakatani Declaration”) on February 27, 2008.

The Nakatani Declaration confirms both by observations on Lange et al. (Exhibit 1 of the Declaration) and experiments (Exhibit 2 of the Declaration) that, by the technique of Lange et al., it is impossible to obtain the silica-containing laminated structure of the present invention. The present invention is advantageous in that the porous silica layer has not only excellent optical characteristics but also high strength.

Further, with respect to Takahashi et al., it should be noted that the technique of Takahashi et al. differs from the technique of Lange et al., such that those skilled in the art would not combine Takahashi et al. with Lange et al. Specific explanations on this point are made below.

Takahashi et al. disclose a “visible light reflection preventing glass plate, said glass plate comprising a glass substrate and a film having an outer surface” (*see*, for example, claim 1 of Takahashi et al.). In contrast, Lange et al. use polymeric substrates as explained later in more detail. Due to the difference in the substrate, Takahashi et al. form a silica coating under very high temperature conditions which is inapplicable to Lange et al.

Specifically, in all of the Examples of Takahashi et al., the silica coatings are formed by sintering the silica particles at very high temperatures (e.g., 500 °C) for a long time (e.g., 1 hour), as apparent from the following descriptions of Takahashi et al.:

“[First Embodiment]

There is provided a mixture of 3.0 parts by weight of hydrolytic condensation polymerization liquid of ethyl silicate (trade name: HAS-10 made by Colcoat Co., SiO₂ content: 10% by weight), 13.3 parts by weight of chain silica colloid (trade name: Snowtex OUP made by Nissan Chemical Industry Co., Ltd. solid content 15% by weight, containing dispersion auxiliary) having an average diameter of about 15 nm and average length of about 170 nm, and 74.9 parts by weight of 2-propanol at room temperature, which is diluted with threefold parts by weight of 2-propanol and stirred at room temperature for 2 hours to obtain a coating solution for forming low refractive index dents and projections layer. The coating solution contains the chain silica fine particles and ethyl silicate in a ratio by weight of 100:15 by conversion into silica, respectively. This coating solution also contains 670 parts by weight of the chain silica fine particles, 45 parts by weight of the water, 4.5 parts by weight of acid catalyst and solvent against 100 parts by weight of silicon compound.

A soda lime silicate glass plate (65 mm × 150 mm × 3 mm) which is surface polished with a cerium oxide type abrasive and washed, and further subjected to supersonic washing in pure water and dried, is immersed in a coating solution for forming the above low refractive index dents and projections layer, and pulling up at a velocity of 20 cm/min. to coat the coating solution on both surfaces of the glass plate. The resulting glass plate is dried at 100 °C. for 30 minutes, and further subjected to heat treatment in an oven at 500 °C. for 1 hour after drying at 250 °C. for 30 minutes to obtain a glass plate having the silica dent and projection film of 140 nm in thickness formed on each surface.” (emphasis added) (col.8, lines 21 to 52); and

[Second Embodiment]

In place of the soda lime silicate glass plate (65 mm × 150 mm × 3 mm) used in First Embodiment, a glass plate for an automobile wind shield having the same soda lime silicate glass composition (about 150 cm × about 60 cm × 3 mm) is used, which is subjected to dip coating, drying, and heat treatment by known step for bending (heat for 15 minutes at 570 °C.) in the same manner as in First Embodiment to produce a glass plate for an automobile wind shield having a silica dent and projection film of thickness 120 nm formed on each surface.” (emphasis added) (col. 11, lines 15 to 24)

(In the rest of the Embodiments of Takahashi et al., the glass plate/silica film laminates obtained in the First and Second Embodiments are used.)

On the other hand, Lange et al. use a polymeric substrate (*see*, for example, col.2, line 36 to 37 of Lange et al.). Needless to say, if the silica particles in a coating formed on a polymeric substrate are sintered at a temperature as high as 500 °C for as long as 1 hour, the polymeric substrate is markedly deteriorated. In fact, in the Examples of Lange et al., the coatings formed on polymeric substrates are dried at relatively low temperatures for a short time, e.g., 100 ° for 2 minutes or 93 °C for three minutes (col. 6, line 24 to 27, and lines 65 to 68 of Lange et al.)

Therefore, those skilled in the art would not contemplate that the technique of Takahashi et al. can be directly applied to Lange et al.

In addition, with respect to the purpose of the high temperature sintering in Takahashi et al., Takahashi et al. describe that the high temperature sintering improves the strength of the resultant silica coating. Specifically, Takahashi et al. disclose:

“According to necessity, heat treatment may be given at a temperature between 400 °C. and 750 °C. for 5 seconds to 5 hours, by which the silica dent and projection film on the surface of the glass substrate becomes strong. This dent and projection film comprises a matrix of silica fine particles and silica (derived from organic metal compound), wherein the chain silica fine particles are fixed to the glass substrate by the silica matrix, and the surface configuration of the chain silica fine particles forms the dents and projections of the film.” (emphasis added) (col.7, lines 31 to 40)

Thus, Takahashi et al. suggest that the sintering at high temperatures is necessary for satisfactory strength of the silica coating on the glass substrate.

Furthermore, it should be noted that, in Takahashi et al., the optical characteristics of the silica coating are poor compared to those of the present invention. More specifically, in the Examples of Takahashi et al., the reflectance (%) (at a wavelength of 550 nm) is measured only in the “First Embodiment”, the “Sixth Embodiment” and the “Seventh Embodiment”. The

reflectance values in the First Embodiment, the Sixth Embodiment and the Seventh Embodiment are 0.8 %, 0.7 % and 2.2 %, respectively (see Table 3 at col. 11 and Table 9 at col. 16 of Takahashi et al.), which are much higher than the upper limit (0.45 %) recited in claim 1 of the present application.

The reason for this is considered to reside in that the specific pore size distribution (represented by formula (1) shown in claim 1 of the present application) is not satisfied in Takahashi et al. Further, the difference in such pore size distribution between the present invention and Takahashi et al. is considered to reside in that, in Takahashi, the silica coating is formed under the above-mentioned very high temperature conditions which are inapplicable to the present invention in which a transparent thermoplastic resin substrate is used.

Needless to say, Takahashi et al. provide no teaching or suggestion that the formation of a silica coating at a lower temperature as in Lange et al. would improve the optical characteristics and strength of the resultant silica coating.

In this connection, it should be noted that, in the art, even an improvement of 0.1 % in reflectance is important, and the difference between the reflectance of 0.45 % (upper limit in claim 1 of the present application) and 0.7 % (lower limit in Takahashi et al.) is of critical importance. Lange et al. attempt to improve the optical characteristics by forming a silica coating on a resin substrate using a non-agglomerated silica particles, however, the reflectance in Lange et al. is 1.0 % at the lowest (see the above-mentioned Nakatani Declaration). Takahashi et al. attempt to improve the optical characteristics by forming a silica coating on a glass substrate by treating moniliform silica strings at very high temperatures (e.g., 500 °C) for a long time. However, the reflectance in Takahashi et al. is 0.7 % at the lowest as explained above. On the

other hand, in the present invention, by forming on a resin substrate a silica layer by moniliform silica strings so that the silica layer has a specific pore size distribution (represented by formula (1) shown in claim 1), both optical characteristics (reflectance is 0.45 % at the highest) and strength of the silica layer are improved, which is quite unexpected and surprising even in view of Lange et al. and Takahashi et al.

From the above, it is apparent:

that Lange et al. teach that “particle agglomeration prior to preparation of the coating composition” should be prevented (at col. 5, lines 28 to 36 of Lange et al.), thus teaching away from the use of moniliform silica strings;

that Takahashi et al. clearly suggest that the application of a coating solution described in Takahashi et al. to Lange et al. sacrifices the strength of the resultant coating; and

that Takahashi et al. do not teach such a low reflectance as recited in claim 1 of the present invention can be achieved by the use of a coating solution containing moniliform silica strings.

Therefore, it is apparent that those skilled in the art would not combine Lange et al. with Takahashi et al.. Moreover, the excellent effects of the present invention (excellent optical characteristics and strength, which could not be simultaneously improved by the conventional techniques) are completely unexpected from Lange et al. and Takahashi et al.

Accordingly, the laminated structure (claim 1) and antireflection films (claims 14 and 15) of the present invention are not obvious over Lange et al., alone or in view of Takahashi et al.

III. Conclusion

In view of the foregoing, Applicants believe the pending application is in condition for allowance. A Notice of Allowance is earnestly solicited.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Monique T. Cole, Reg. No. 60,154 at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.17; particularly, extension of time fees.

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Respectfully submitted,

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